2017. Journal of Arachnology 45:242–247

SHORT COMMUNICATION

Spiders feeding on earthworms revisited: consumption of giant earthworms in the tropics

Martin Nyffeler[1], **Witold Lapinski**[2], **Andrew Snyder**[3] and **Klaus Birkhofer**[4,5]: [1]Section of Conservation Biology, Department of Environmental Sciences, University of Basel, CH-4056 Basel, Switzerland. E-mail: martin.nyffeler@unibas.ch; [2]Institute of Evolutionary Ecology and Conservation Genomics, University of Ulm, 89069 Ulm, Germany; [3]Department of Biology, University of Mississippi, Oxford, MS 38677, USA; [4]Department of Biology, Lund University, SE-223 62 Lund, Sweden; [5]Chair of Ecology, Brandenburg University of Technology Cottbus-Senftenberg, 03046 Cottbus, Germany

Abstract. Predation on earthworms is common in some generalist predator species, as for example several ground beetle species (Coleoptera: Carabidae) that frequently feed on earthworms. In spiders (Araneae), however, such behavior is far less well documented. A survey of reports on spiders feeding on earthworms yielded a total of 44 naturally occurring predation events. Spiders from 14 families were observed feeding on earthworms in nature, and species from two additional families consumed earthworm prey in captivity. Earthworm predation by spiders has been observed in temperate, subtropical, and tropical regions in 18 different countries. Tropical spiders from the families Theraphosidae (Mygalomorphae) and Ctenidae (Araneomorphae) accounted for 59% of the reported predation events. Reports from French Guiana document the capture of giant earthworms (0.6–1 m in length) by the giant tarantula, *Theraphosa blondi* (Latreille, 1804). Predation on giant earthworms by large tarantulas has also been observed in rainforest habitats in Brazil, Ecuador, Peru, and Venezuela. Wandering spiders (Ctenidae) are known to feed on earthworms in Belize, Brazil, Costa Rica, French Guiana, Guyana, and Singapore. Quite obviously, larger-sized mygalomorph and araneomorph spiders in humid tropical rainforests are predators with broad feeding niches—including earthworms and vertebrate prey in addition to arthropod prey—and this is presumed to improve the survival of these spiders. By comparison, reports of earthworm predation in temperate climate are rarer, and recent molecular studies of the diet composition of lycosid and linyphiid spider species in Swedish arable fields suggest that earthworms are not a common prey of these species.

Keywords: Oligochaeta, Ctenidae, Theraphosidae, generalist predators, diet composition

Predation on earthworms is common in some generalist predator species, as for example several ground beetle species (Coleoptera: Carabidae) that frequently feed on earthworms (King et al. 2010). In spiders (Araneae), however, such behavior is far less well documented, as spiders are predominately predators of arthropods, with insects by far being the most dominant prey group (Nyffeler 1999; Birkhofer & Wolters 2012; Pekár & Toft 2015). In addition, some spider species are known to occasionally include small vertebrates in their diets (McCormick & Polis 1982; Henschel 1994; Menin et al. 2005; Nyffeler & Knörnschild 2013; de Carvalho et al. 2016; Nyffeler et al. 2017). Still other spiders use plant food to supplement their diets (Nyffeler et al. 2016). It has further been documented that some spider species also feed on unusual prey such as slugs, snails, velvet worms, polychaete worms, woodlice, amphipods, shrimps, crayfish, or freshwater crabs (McLay & Hayward 1987; Nyffeler & Symondson 2001; Nyffeler & Pusey 2014; Bhukal et al. 2015; Pekár & Toft 2015; Franco & Monge-Nájera 2016). According to a previous assessment by Nyffeler et al. (2001), spiders from eight families also feed on earthworms under natural conditions.

Over the last 15 years, new evidence of earthworm predation by spider species has been published in the scientific literature or on the internet. Here we update a previous assessment (Nyffeler et al. 2001) and discuss the overall evidence for earthworm predation in spiders to provide a more realistic view on the commonness and taxonomic or geographic patterns. We define earthworms as oligochaete worms represented by several families which live in the litter layer or in soil, and feed on dead organic matter (Lal 2006).

An extensive bibliographic search was conducted to identify all published reports on predation on earthworms by spiders using the ISI Web of Science Thomson-Reuters database, Scopus database, Google Scholar, Google Books, and Google Pictures. Social media sites were also searched for content indicating earthworm predation by spiders. Furthermore, inquiries among biologists were undertaken for unpublished reports on this topic. In total, we found 44 reports of predation on earthworms by spiders, about half of which had previously been published in the scientific literature (Appendix 1).

Overall, spiders from 14 families (Agelenidae, Atypidae, Ctenidae, Hexathelidae, Lycosidae, Pisauridae, Salticidae, Segestriidae, Sicariidae, Sparassidae, Tetragnathidae, Theraphosidae, Theridiidae, Thomisidae) have been reported to feed on earthworms in nature, and individuals from two more families (Amaurobiidae, Araneidae) accepted earthworm prey in captivity (Appendix 1). It should be noted that the majority (>75%) of reported cases of predation on earthworms refers to spiders that forage as active hunters without the use of a catching web (see Fig. 1A for an exception).

So far, predation on earthworms has been reported from all continents except Africa and Antarctica (Appendix 1). This type of predator-prey interaction occurs in temperate, subtropical, and tropical climates. In the temperate regions of Europe and North America, earthworms consumed by spiders usually are members of the family Lumbricidae (e.g., Fig. 1B). A case of this trophic interaction was filmed in a park in Amsterdam, Netherlands. This video documents a crab spider (*Xysticus ulmi* (Hahn, 1831)) killing an earthworm about 13 times longer than itself (online at https://www.youtube.com/watch?v=a9lf3tKw1E0). In another instance, a small linyphiid spider (*Macrargus rufus* (Wider, 1834)) was seen feeding on a potworm (Enchytraeidae) in a forest habitat in Belgium (Rudy Jocqué, pers. comm.). This incident is not included in our assessment (Appendix 1), since potworms are not regarded as earthworms in the strict sense (see Sims & Gerard 1985). However, due to the close taxonomic relationship between potworms and earthworms (both

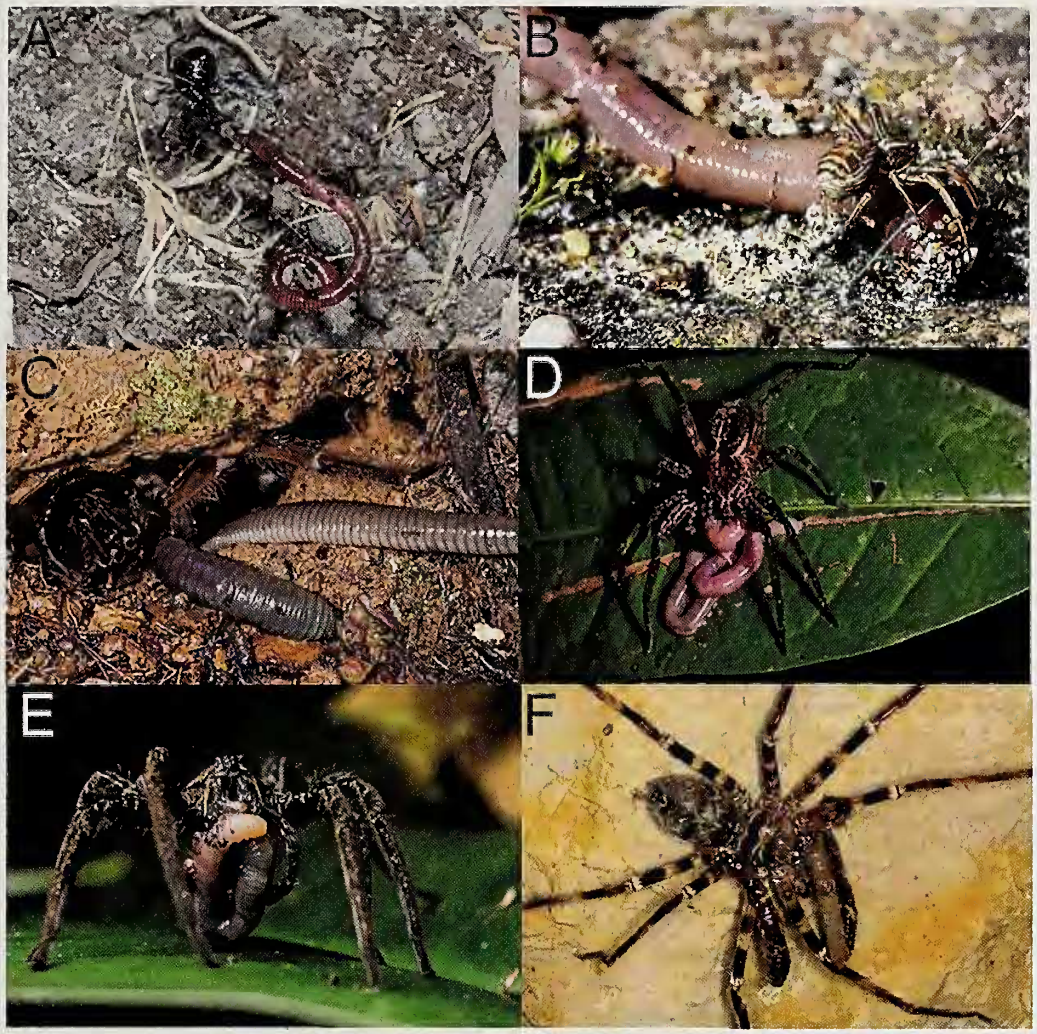

Figure 1.—Photographic evidence of earthworm predation by spiders. A. Redback spider (*Latrodectus hasselti*) with unidentified earthworm prey in its web in a garden in Melbourne, Australia (photo by Iain Duncan). B. Crab spider *Xysticus ulmi* killing a lumbricid earthworm in a park in Amsterdam, Netherlands (Copyright: Sammy Jean Cunze, itsVision.tv). C. *Theraphosa blondi* pulling a captured giant earthworm (presumably *Rhinodrilus* sp.) into its burrow in rainforest in French Guiana (photo by C.E. Timothy Paine). D. *Ctenus* sp. feeding on an earthworm in rainforest in Guyana (photo by Andrew Snyder). E. Ctenid spider feeding on an unidentified earthworm in rainforest in Belize (photo by Anton Sorokin). F. *Heteropoda maxima* feeding on an unidentified earthworm near Ban Koenphavang, Laos (photo by Peter Jäger).

being oligochaete worms with similar *modus vivendi*), we feel that this case should be mentioned in this review.

In the northern part of South America, large fossorial tarantulas have been observed catching and consuming giant earthworms (Appendix 1). A very impressive predation event was observed in a tropical rainforest at the Nouragues Biological Station, French Guiana. A giant tarantula, *Theraphosa blondi* (Latreille, 1804), was recorded feeding on a giant earthworm of 50–60 cm length. The spider was sitting in its burrow and half of the earthworm was pulled into the burrow while the other half was visible (W. Lapinski, pers. obs.). Another impressive scene was observed in the same area near Nouragues. Here, a *T. blondi* individual was seen slowly pulling a giant earthworm of approx. 1 m length into its burrow (Fig. 1C; C.E. Timothy Paine, pers. comm.). Paine stated "....The earthworm was stretched across a trail through the rainforest, grasping (as best he could) to anything for friction. The tarantula was pulling the earthworm from about ⅓ of the way along the body. So the earthworm was trying to cling to the soil with both ends. It was stretched taut...." The way the giant earthworm was pulled into the burrow resembles the way snakes are captured and pulled into burrows by this tarantula species (Rick West, pers. comm.; Gordon 1993). The observer watched the scene for about 10 minutes, took photos (Fig. 1C), and left. When he returned to the scene about one hour later, spider and earthworm had disappeared. Although it has not been documented that the spider actually killed and ate the earthworm, it can be strongly suspected that the spider devoured the earthworm out of human sight after pulling it into its burrow (C.E. Timothy Paine, pers. comm.). According to Rick West (pers. comm.) at least half a dozen theraphosid spider interactions with earthworms witnessed in tropical rainforests have all been predation events where the earthworm was dragged into the spider's burrow, killed, and consumed. Based on photos (Fig. 1C) the captured giant earthworm most likely belonged to a species in the genus *Rhinodrilus*, placed in the family Rhinodrilidae by some taxonomists (Tomas Pavlíček, pers. comm.; Csaba Csuzdi, pers. comm.) and in the family Glossoscolecidae by other taxonomists (Emmanuel Lapied, pers. comm.). In another instance, a *T. blondi* individual consumed an earthworm of 30 cm length near Manaus, Brazil (Nyffeler et al. 2001). Other incidents of *T. blondi* consuming earthworms occurred in the Kaw Mountains, French Guiana (Rick West, pers. comm.) and in Guyana (Lewis

2014). Furthermore, large tarantulas – *Theraphosa apophysis* (Tinter, 1991) and *Megaphobema velvetosoma* Schmidt, 1995 – were witnessed feeding on giant earthworms in Venezuela, Ecuador, and Peru (Rick West, pers. comm.).

A second group of tropical rainforest spiders frequently consuming earthworms are wandering spiders from the family Ctenidae (Fig. 1D & E; Andrew Snyder, pers. obs.). The earthworm depicted in Fig. 1D most likely belongs to a species placed in the family Rhinodrilidae (Csaba Csuzdi, pers. comm.; Tomas Pavlíček, pers. comm.) or Glossoscolecidae (Emmanuel Lapied, pers. comm.). Such incidents of ctenids consuming earthworms have been observed and photographed in Belize, Brazil, Costa Rica, French Guiana, Guyana, and Singapore (Appendix 1). *Ctenus* spp. in particular are abundant inhabitants of tropical rainforests (Portela et al. 2013). They are mainly nocturnal spiders that forage by ambushing prey on the leaf litter and low understory vegetation (Almeida et al. 2000; Salvestrini & Gasnier 2001; Gasnier et al. 2002). These medium-sized to large spiders may have 0.7–2.2 g body mass and are capable of catching prey ranging from 0.5–1.5 g (Lapinski & Tschapka 2013, 2014). A giant huntsman spider (*Heteropoda maxima* Jäger, 2001; Sparassidae) with a legspan of approx. 20 cm has also been observed feeding on an earthworm in Laos (Fig. 1F; Peter Jäger, pers. comm.). This spider species typically lives near cave entrances (Jäger 2001).

Large tarantulas such as *T. blondi* reach body weights of 25–65 g, with a maximum of up to >100 g (Saul-Gershenz 1996; Zachariah et al. 2007; Smith 2008). Such heavy spider species have high energy requirements and can be expected to feed on large prey organisms such as small vertebrate species (McCormick & Polis 1982; Menin et al. 2005). A giant earthworm, which can reach a body weight of >100 g (Moreno & Paoletti 2004), is a very profitable prey item for these giant tarantulas. Furthermore, giant earthworms are high quality prey characterized by high protein content (Moreno & Paoletti 2004) and may not pose a large risk to predators due to their limited defense abilities. The observation of spiders feeding on giant earthworms is generally important, as little is known about the natural enemies of giant earthworms (e.g., O'Donnell et al. 2005; Strüssmann et al. 2013).

Tropical spiders from the families Theraphosidae and Ctenidae accounted for 59% of the reported incidents of earthworm predation by spiders. Spiders from these families are typical generalist predators with broad feeding niches (Brunet 1998; Lapinski & Tschapka 2013; Lewis 2014; de Carvalho et al. 2016; Rick West, pers. comm.). The fact that they capture a large variety of different prey types including arthropods, vertebrates and even earthworms is presumed to improve their survival in humid tropical rainforests (also see Nyffeler et al. 2017). In temperate regions, predator-prey interactions between spiders and earthworms seem to be less common, as indicated by recent molecular tests on lycosid and linyphiid species in arable fields in Sweden (Roubinet et al. 2017). On the other hand, temperate region earthworms (Oligochaeta: Lumbricidae) can compose a substantial portion (up to almost 50%) in the diets of arachnids of the genera *Leiobunum* C.L. Koch, 1839 and *Hadrobunus* Banks, 1900 (Opiliones: Sclerosomatidae) (Halaj & Cady 2000); such earthworm-eating harvestmen, however, are facultative predators getting access to earthworm prey rather by scavenging.

ACKNOWLEDGMENTS

Thanks to Antonio Brescovit (Instituto Butantan, Sao Paulo), Hubert Höfer (State Museum of Natural History Karlsruhe), Peter Jäger (Senckenberg Research Institute and Natural History Museum Frankfurt), and Rick West (Sooke, British Columbia) for identifying spiders in photos. We also thank Csaba Csuzdi (Eszterházy Károly University), Emmanuel Lapied (Norwegian University of Life Sciences) and Tomas Pavlíček (University of Haifa) for identifying a giant earthworm based on photos. We are very much indebted to the following scientists providing us with unpublished information: Thierry Gasnier (Fundação Universidade do Amazonas, Manaus), Peter Jäger, Rudy Jocqué (Royal Museum for Central Africa, Tervuren), C.E. Timothy Paine (University of Stirling), and Rick West. Comments of Thomas Jones (East Tennessee State University) and two anonymous reviewers helped to improve the manuscript. Finally, we are very grateful to all those who gave permission to use their photos.

LITERATURE CITED

Almeida, C.E., E.F. Ramos, E. Gouvea, M.D. Carmo-Silva & J. Costa. 2000. Natural history of *Ctenus medius* Keyserling, 1891 (Araneae, Ctenidae) I: observations on habitats and the development of chromatic patterns. Revista Brasileira de Biologia 60:503–509.

Bhukal, R., M.G. Rutherford & R.S. Mohammed. 2015. Predation on a freshwater crab, *Dilocarcinus dentatus* (Tricodactylidae), by several tropical wolf spiders, *Ancylometes bogotensis* (Ctenidae), in Trinidad, W. I. Living World, Journal of the Trinidad and Tobago Field Naturalists' Club 2015:59–60. Online at http://ttfnc.org/livingworld/index.php/lwj/issue/view/5

Birkhofer, K. & V. Wolters. 2012. The global relationship between climate, net primary production and the diet of spiders. Global Ecology and Biogeography 21:100–108.

Brunet, B. 1998. Spiderwatch: A Guide to Australian Spiders. New Holland Publishers, Sydney, Australia.

de Carvalho, W.D., D. Norris & F. Michalski. 2016. Opportunistic predation of a common scale-backed antbird (*Willisornis poecilinotus*) by a Goliath bird-eating spider (*Theraphosa blondi*) in the Eastern Brazilian Amazon. Studies on Neotropical Fauna and Environment 51:239–241.

Fischer, M.L., J. Vasconcellos-Neto & L.G. dos Santos Neto. 2006. The prey and predators of *Loxosceles intermedia* Mello-Leitão 1934 (Araneae, Sicariidae). Journal of Arachnology 34:485–488.

Franco, R. & J. Monge-Nájera. 2016. Inverted roles: Spider predation upon Neotropical velvet worms (*Epiperipatus* spp.; Onychophora: Peripatidae). Research Journal of the Costa Rican Distance Education University 8:171–173.

Gasnier, T.R., C.S. de Azevedo, M.P. Torres-Sanchez & H. Höfer. 2002. Adult size of eight hunting spider species in central Amazonia: temporal variations and sexual dimorphisms. Journal of Arachnology 30:146–154.

Gordon, N. 1993. Tarantula! [videorecording]; Survival Anglia, Summit Television production.

Halaj, J. & A.B. Cady. 2000. Diet composition and significance of earthworms as food of harvestmen (Arachnida: Opiliones). American Midland Naturalist 143:487–491.

Henschel, J.R. 1994. Diet and foraging behaviour of huntsman spiders in the Namib dunes (Araneae: Heteropodidae). Journal of Zoology 234:239–251.

Jäger, P. 2001. A new species of *Heteropoda* (Araneae, Sparassidae, Heteropodinae) from Laos, the largest huntsman spider? Zoosystema 23:461–465.

King, R.A., I.P. Vaughan, J.R. Bell, D.A. Bohan & W.O. Symondson. 2010. Prey choice by carabid beetles feeding on an earthworm community analysed using species-and lineage-specific PCR primers. Molecular Ecology 19:1721–1732.

Lal, R. 2006. Encyclopedia of Soil Science, 2nd edition. CRC Press, Boca Raton, USA.

Lapinski, W. & M. Tschapka. 2013. Habitat use in an assemblage of Central American wandering spiders. Journal of Arachnology 41:151–159.

Lapinski, W. & M. Tschapka. 2014. Desiccation resistance reflects patterns of microhabitat choice in a Central American assemblage of wandering spiders. Journal of Experimental Biology 217:2789–2795.

Lewis, T. 2014. Puppy-sized spider surprises scientist in rainforest. LiveScience, October 17, 2014. Online at http://www.livescience.com/48340-goliath-birdeater-surprises-scientist.html

McCormick, S. & G.A. Polis. 1982. Arthropods that prey on vertebrates. Biological Reviews 57:29–58.

McLay, C.L. & T.L. Hayward. 1987. Population structure and use of *Durvillaea antarctica* holdfasts by the intertidal spider *Desis marina* (Araneae: Desidae). New Zealand Journal of Zoology 14:29–42.

Menin, M., D. de Jesus Rodrigues & C.S. de Azevedo. 2005. Predation on amphibians by spiders (Arachnida, Araneae) in the Neotropical region. Phyllomedusa: Journal of Herpetology 4:39–47.

Moreno, A.G. & M.G. Paoletti. 2004. *Andiorrhinus* (*Andiorrhinus*) *kuru* sp. nov. (Oligochaeta: Glossoscolecidae), a giant earthworm as food resource for Makiritare Indians of the Alto Rio Padamo, Amazonas, Venezuela. Canadian Journal of Zoology 82:1000–1004.

Nyffeler, M. 1982. Field studies on the ecological role of the spiders as insect predators in agroecosystems. PhD Dissertation, Swiss Federal Institute of Technology, Zurich, Switzerland.

Nyffeler, M. 1999. Prey selection of spiders in the field. Journal of Arachnology 27:317–324.

Nyffeler, M., G.B. Edwards & K.L. Krysko. 2017. A vertebrate-eating jumping spider (Araneae: Salticidae) from Florida, USA. Journal of Arachnology 45(2): 238–241.

Nyffeler, M. & M. Knörnschild. 2013. Bat predation by spiders. PLoS One 8:e58120.

Nyffeler, M., H. Moor & R.F. Foelix. 2001. Spiders feeding on earthworms. Journal of Arachnology 29:119–124.

Nyffeler, M., E.J. Olson & W.O.C. Symondson. 2016. Plant-eating by spiders. Journal of Arachnology 44:15–27.

Nyffeler, M. & B.J. Pusey. 2014. Fish predation by semi-aquatic spiders: a global pattern. PLoS One 9:e99459.

Nyffeler, M. & W.O.C. Symondson. 2001. Spiders and harvestmen as gastropod predators. Ecological Entomology 26:617–628.

O'Donnell, S., M. Kaspari & J. Lattke. 2005. Extraordinary predation by the Neotropical army ant *Cheliomyrmex andicola*: Implications for the evolution of the army ant syndrome. Biotropica 37:706–709.

Pekár, S. & S. Toft. 2015. Trophic specialisation in a predatory group: the case of prey-specialised spiders (Araneae). Biological Reviews 90:744–761.

Portela, E., R.H. Willemart & T.R. Gasnier. 2013. Soil type preference and the coexistence of two species of wandering spiders (*Ctenus amphora* and *C. crulsi*: Ctenidae) in a rainforest in Central Amazonia. Journal of Arachnology 41:85–87.

Ross, L. K. 2008. A jumping spider feeding on an earthworm. Peckhamia 71(1):1–2.

Roubinet, E., K. Birkhofer, G. Malsher, K. Staudacher, B. Ekbom & M. Traugott. 2017. Diet of generalist predators reflects effects of cropping season and farming system on extra- and intraguild prey. Ecological Applications doi:10.1002/eap.1510

Salvestrini, F.M. & T.R. Gasnier. 2001. Differences in the activity of juveniles, females and males of two hunting spiders of the genus *Ctenus* (Araneae, Ctenidae): active males or inactive females? Journal of Arachnology 29:276–278.

Saul-Gershenz, L. 1996. Laboratory culture techniques for the Goliath tarantula *Theraphosa blondi* (Latreille, 1804) and the Mexican red knee tarantula, *Brachypelma smithi* (Araneae: Theraphosidae). Pp. 773–777. *In* American Zoo and Aquarium Association Regional Conference Proceedings.

Savory, T.H. 1926. British Spiders (Their Haunts and Habits). Clarendon Press, Oxford, UK.

Sims, R.W. & B.M. Gerard. 1985. Earthworms. Keys and notes to the identification and study of the species. Synopsis of the British Fauna (New series) No. 31. E.J. Brill, Leiden, The Netherlands.

Smith, F.A. 2008. Body size, energetics and evolution. Pp. 477–482. *In* Encyclopedia of Ecology. (S.E. Jørgensen, B.D. Fath, eds.). Elsevier, Oxford, UK.

Smithers, P. 1996. Observations on prey of the cave spider *Meta menardi* (Latreille, 1804) in South Devon. Newsletter of the British Arachnological Society 77:12–14.

Strüssmann, C., E.S. de Brito & O.A.V. Marques. 2013. What do water snakes eat? First report of predation by a Neotropical Hydropsini snake on giant earthworms (Glossoscolecidae). Salamandra 49:48–50.

Vogel, B.R. 1971. Individual interactions of *Pardosa*. Armadillo Papers 5:1–12.

Zachariah, T.T., M.A. Mitchell, C.M. Guichard & R.S. Singh. 2007. Hemolymph biochemistry reference ranges for wild-caught goliath birdeater spiders (*Theraphosa blondi*) and Chilean rose spiders (*Grammostola rosea*). Journal of Zoo and Wildlife Medicine 38:245–251.

Manuscript received 8 February 2017, revised 3 April 2017.

Appendix 1.—Records of spiders feeding on earthworms (44 records from the field and 3 records from spiders in captivity).

Spider taxonomic classification	Country	Type of evidence	Source
MYGALOMORPHAE			
Theraphosidae			
Theraphosa apophysis (Tinter, 1991)	Venezuela	Field observation	Rick West (pers. comm.)
	Venezuela	Field observation	Rick West (pers. comm.)
	Venezuela	Field observation	Rick West (pers. comm.)
	Venezuela	Field observation	Rick West (pers. comm.)
Theraphosa blondi (Latreille, 1804)	Brazil	Field observation	Nyffeler et al. (2001)
	French Guiana	Photo	C.E. Timothy Paine (pers. comm.)
	French Guiana	Field observation	Rick West (pers. comm.)
	French Guiana	Field observation	Witold Lapinski (pers. obs.)
	Guyana	Field observation	Lewis (2014)
	N. South America	Photo	Francesco Tomasinelli[A]
Megaphobema velvetosoma Schmidt, 1995	Peru	Field observation	Rick West (pers. comm.)
	Ecuador	Field observation	Rick West (pers. comm.)
Atypidae			
Atypus affinis Eichwald, 1830	United Kingdom	Field observation	Savory (1926)
Hexathelidae			
Hadronyche versuta (Rainbow, 1914)	Australia	Field observation	Brunet (1998)
ARANEOMORPHAE			
Agelenidae			
Eratigena atrica (C.L. Koch, 1843)	Switzerland	Field observation	Nyffeler et al. (2001)
Tegenaria sp.	France	Field observation	Nyffeler et al. (2001)
Amaurobiidae			
Amaurobius fenestralis (Stroem, 1768)	In captivity	Observation in captivity	Nyffeler et al. (2001)
Amaurobius ferox (Walckenaer, 1830)	In captivity	Observation in captivity	Nyffeler et al. (2001)
Araneidae			
Araneus diadematus Clerck, 1757	In captivity	Observation in captivity	Nyffeler et al. (2001)
Ctenidae			
Ancylometes rufus (Walckenaer, 1837)	Brazil	Field observation	Nyffeler et al. (2001)
Ancylometes sp.	Belize	Field observation	Anton Sorokin (pers. comm.)
Ctenus amphora Mello-Leitão, 1930	Brazil	Field observation	Thierry Gasnier (pers. comm.)
	Brazil	Field observation	Thierry Gasnier (pers. comm.)
Ctenus crulsi Mello-Leitão, 1930	Brazil	Field observation	Thierry Gasnier (pers. comm.)
	Brazil	Field observation	Thierry Gasnier (pers. comm.)
	Brazil	Field observation	Thierry Gasnier (pers. comm.)
Ctenus curvipes (Keyserling, 1881)	Costa Rica	Photo	Philipp Ric. Figueroa[B]
Ctenus sp.	Guyana	Photo	Andrew Snyder (pers. obs.)
	French Guiana	Photo	Anonymous[C]
	Singapore	Photo	Christopher Teo[D]
	Singapore	Photo	Adrian Cho[E]
	South East Asia	Photo	Joseph Ang[F]
	South East Asia	Photo	Eldie Aaron Justim[G]
Lycosidae			
Pardosa sp.	USA	Field observation	Vogel (1971)
Trochosa terricola Thorell, 1856	France	Field observation	Nyffeler et al. (2001)
Unknown	USA (Pennsylvania)	Field observation	Darryl Moran[H]
	USA (Michigan)	Field observation	Anonymous[I]
Pisauridae			
Dolomedes sp.	Germany	Video	Peter Blendowski[J]
Salticidae			
Platycryptus undatus (De Geer, 1778)	USA (Michigan)	Field observation	Ross (2008)
Segestriidae			
Segestria florentina (Rossi, 1790)	France	Field observation	Nyffeler et al. (2001)
Sicariidae			
Loxosceles intermedia Mello-Leitão, 1934	Brazil	Prey found in web	Fischer et al. (2006)
Sparassidae			
Heteropoda maxima Jäger, 2001	Laos	Photo	Peter Jäger (pers. comm.)
Tetragnathidae			
Meta menardi (Latreille, 1804)	United Kingdom	Prey found in web	Smithers (1996)
Theridiidae			
Latrodectus hasselti Thorell, 1870	Australia	Photo	Iain Duncan (pers. comm.)

Appendix 1.—Continued.

Spider taxonomic classification	Country	Type of evidence	Source
Thomisidae			
Xysticus ulmi (Hahn, 1831)	Netherlands	Video	Dagmar Cunze[K]
Xysticus sp.	Switzerland	Field observation	Nyffeler (1982)
	Switzerland	Field observation	Nyffeler et al. (2001)

[A] Francesco Tomasinelli: online at http://www.arkive.org/goliath-bird-eating-spider/theraphosa-blondi/image-G112597.html
[B] Philipp Ric. Figueroa: online at https://www.flickr.com/photos/80335180@N06/16578886018
[C] Anonymous : online at https://www.flickr.com/photos/60313790@N08/5539782616
[D] Christopher Teo: online at https://www.flickr.com/photos/snapperholic/3372187502/in/photolist-68ZkRQ
[E] Adrian Cho: online at https://www.flickr.com/photos/adriancho/3351350135
[F] Joseph Ang: online at https://www.flickr.com/photos/parampita2009/3351265515/in/album-72157612958642434/
[G] Eldie Aaron Justim: online at https://www.shutterstock.com/de/pic-432352723/stock-photo-wandering-spider-with-a-worm-prey.html?src=2sqDzsMDQZEOGel9dmvmig-1-23
[H] Darryl Moran: online at https://www.flickr.com/photos/dwmoran/5880202140/in/photostream/
[I] Anonymous: online at http://i.imgur.com/FNYHAG7.jpg
[J] Peter Blendowski: online at https://www.youtube.com/watch?v=a89RyuDstus
[K] Dagmar Cunze: online at: https://www.youtube.com/watch?v=a9lf3tKw1E0